TII:

Multistage Amplifiers

Unclassified

2 Hour Conference, W/ 3Hr PE1

Safety & Environmental Impact is “LOW”

TII: Multistage Amplifiers

Terminal Learning Objective

Action: Given Schematic Ckt diagrams answer questions on the operation & troubleshooting of transistors configured as Complementary pairs, Power amplifiers and Driver Ckts. In addition concepts pertaining to Impedance matching & Crossover Distortion.

Condition: W/O References.

Standard: Seven of ten questions answered correctly.

TII: Multistage Amplifiers

Introduction

In conjunction w/ previous lessons this lesson elaborates on the need for Impedance matching, & the requirements of the Power Amplifier.

When you consider the highly mobile Army of today, & the types of equipment that are fielded it soon becomes apparent that Energy becomes a prime concern and the efficient use of it. This energy be it fuel for generators or some other type, has to be transported to the site. Our equipment has been designed for the efficient use of power while still being able to accomplish the mission objectives.

TII: Multistage Amplifiers

Power; Is the rate of work, measured in units of Watts.

Power Formula;

P I E

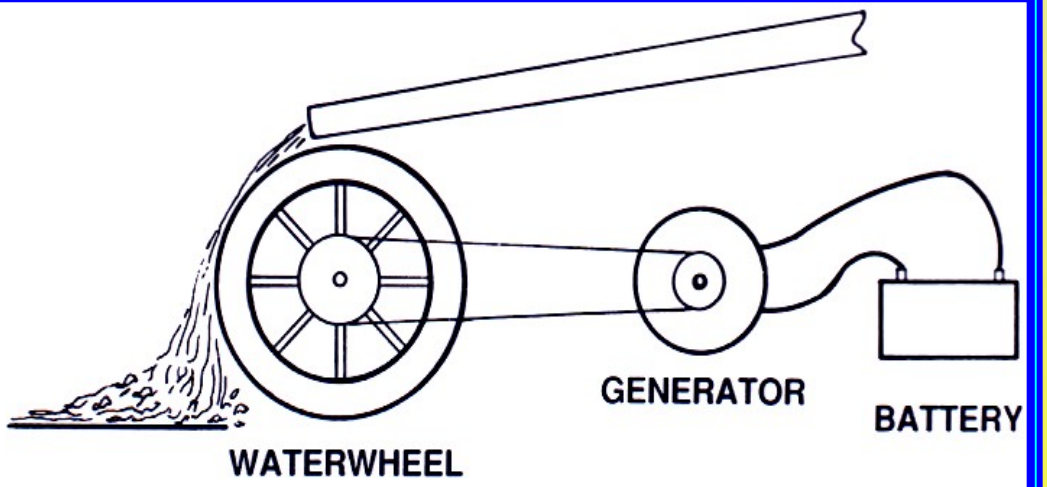
Power = Current X Voltage

Power is a product of Voltage & Current

Other Formulas;

$$P = I^2 \times R$$

$$P = E^2 / R$$



The waterwheel; Potential energy is converted to mechanical, mechanical to electrical. In the process much energy is lost to resistance.

Speaker

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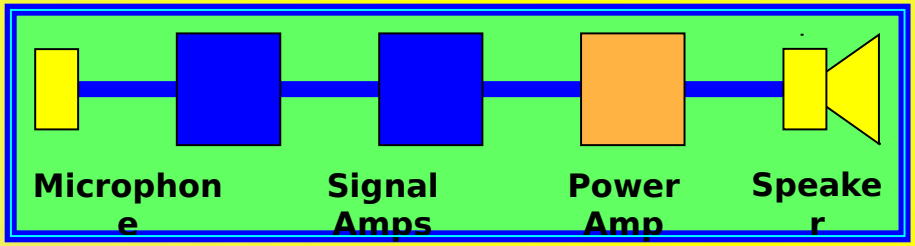
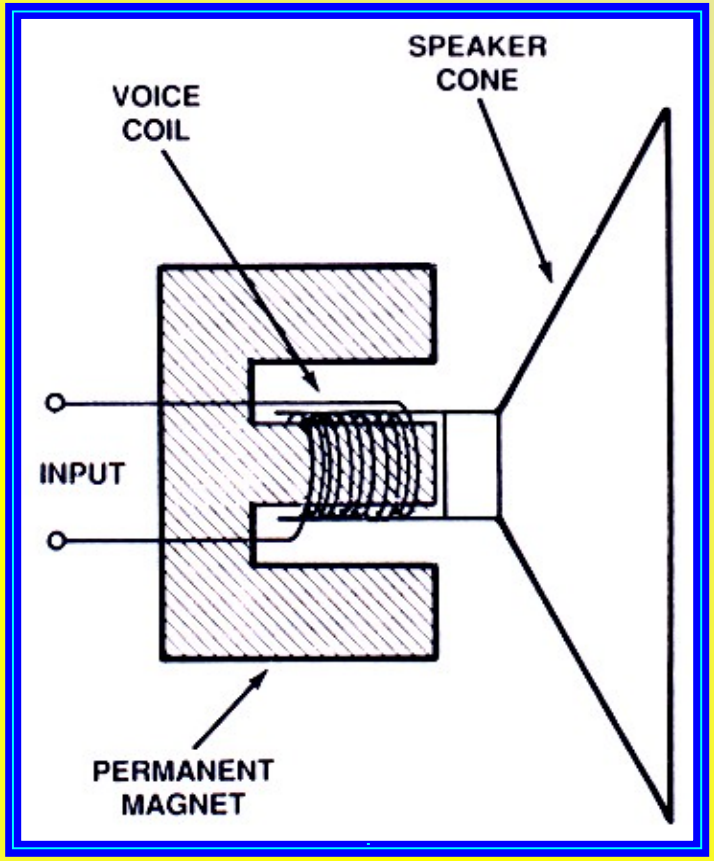
Power Amplifier;





A power amplifier designed to take a small signal voltage and boost it w/enough power to convert its energy from electrical to mechanical. This must be accomplish with maximum efficiency of transfer to prevent power loss.

The speaker is the devise used to transfer <u>electrical energy to mechanical</u>. Professionally referred to as a <u>transducer</u>.

<u>Impedance Matching</u>;

<u>Maximum transfer of power</u>.

When, the output Z matches the Load Z

PWR Develop/Delivered

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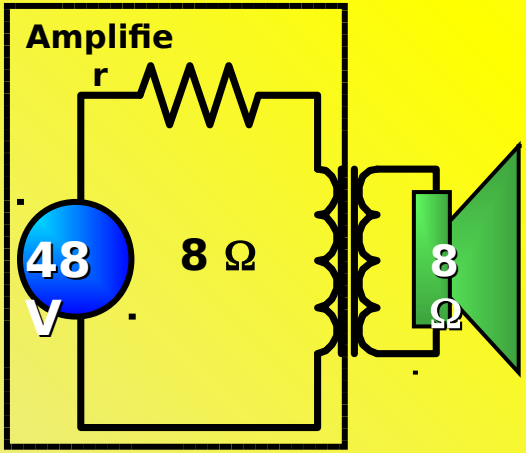
Power Mismatch; Less power Developed, Delivered.



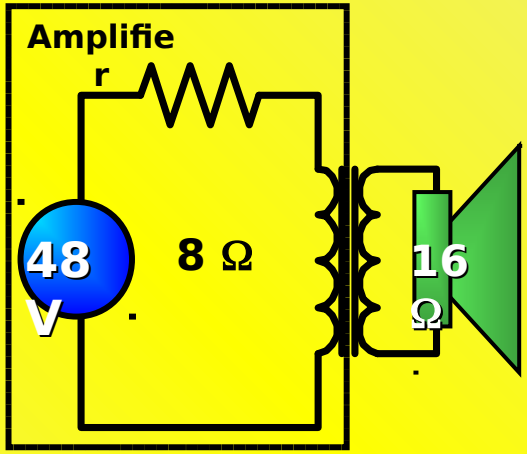
RT = _____

IT = _____

E_{RL} = _____

P_{RL} = _____

Maximum transfer of power



8 + 8

EA /RT

IT X RL

E_{RL} X IT

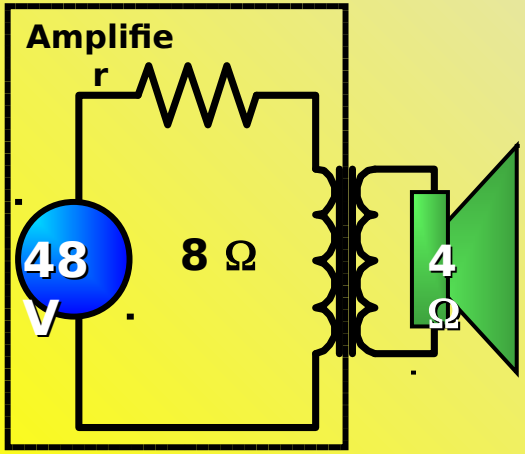
RT = _____

IT = _____

E_{RL} = _____

P_{RL} = _____

Less Power Delivered



RT = _____

IT = _____

E_{RL} = _____

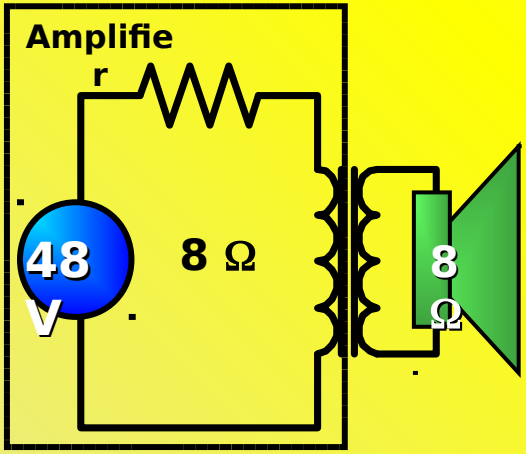
P_{RL} = _____

Less Power Develop

Answers

TII: Multistage Amplifiers

Power Mismatch; Less power Developed, Delivered.



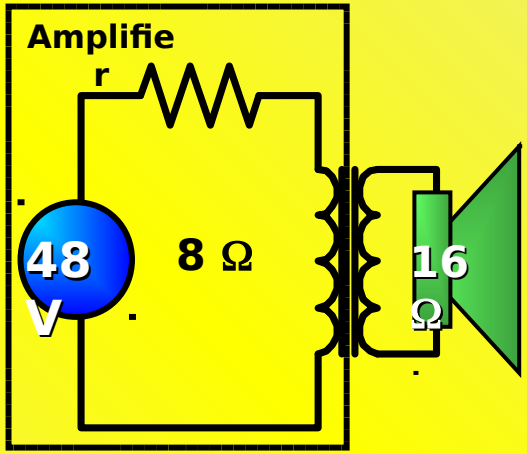
R_T = 16 Ω 8 + 8

I_T = 3 Amps 48/16

E_{RL} = 24 V 3 X 8

P_{RL} = 72 W 24 X 3

Maximum transfer of power



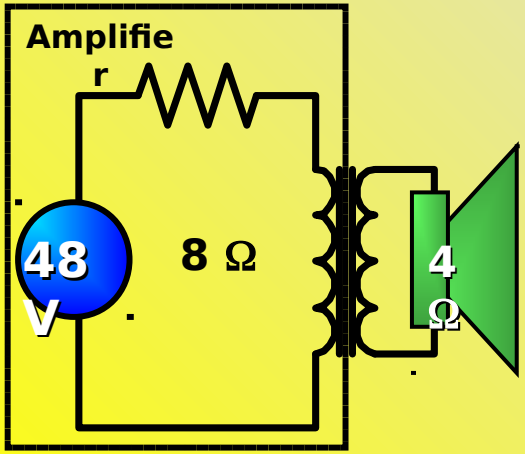
R_T = 24 Ω

I_T = 2 A

E_{RL} = 32 V

P_{RL} = 64 W

Less Power Delivered



R_T = 12 Ω

I_T = 4 A

E_{RL} = 16 V

P_{RL} = 64 W

Less Power Develop

Challenge

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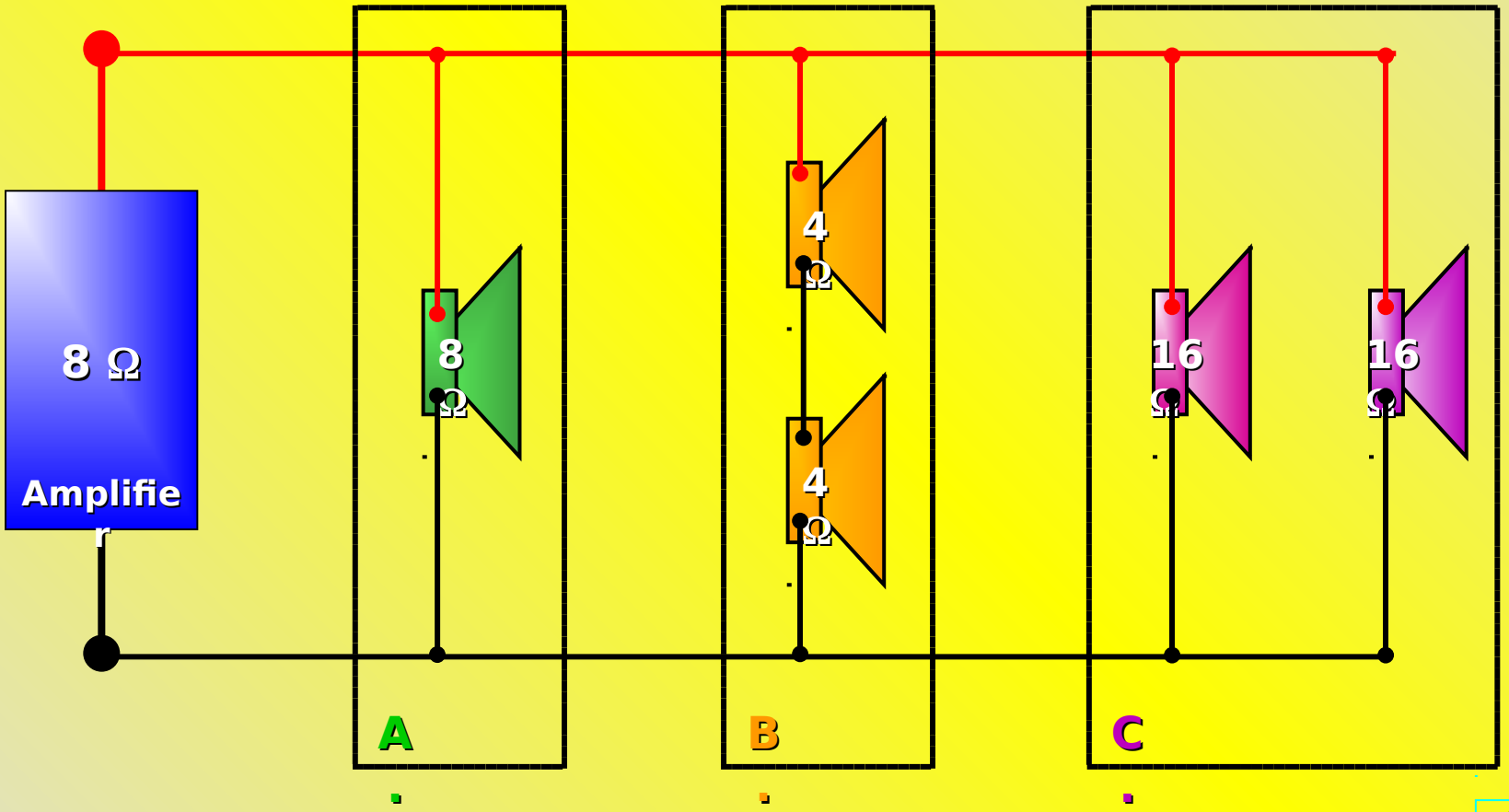
Power; Which Speakers Are Impedance Matched A, B or C?



Class A

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Class A Ops;

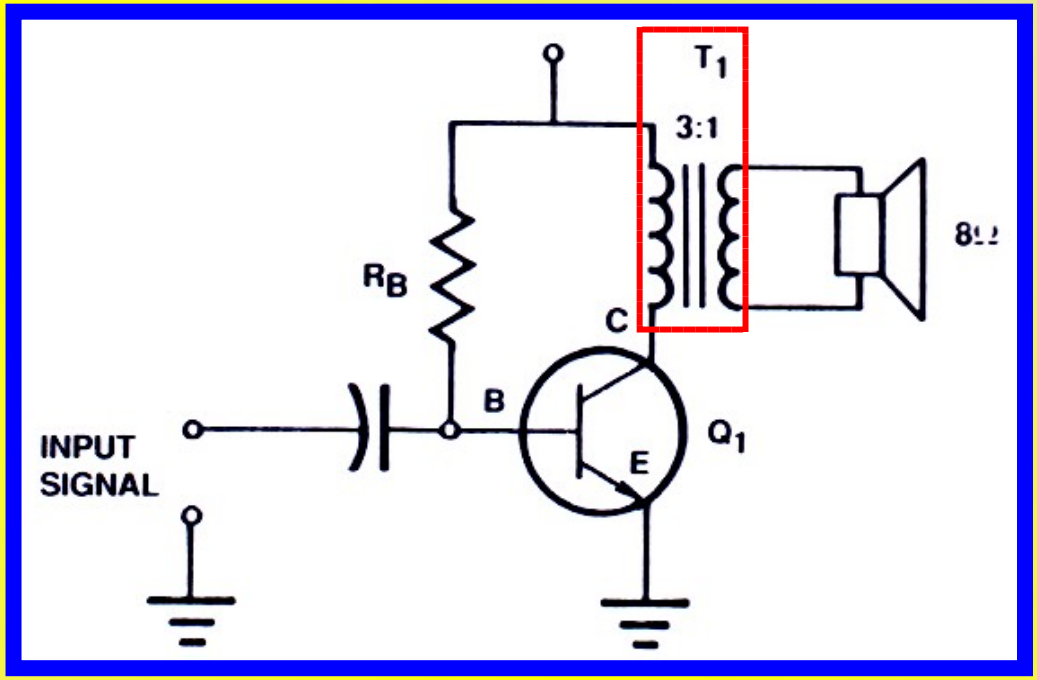
3 objectives of a power Amp;

Minimum Distortion.

Maximum Pwr Output.

Maximum Pwr Efficiency.

Some trade offs exist.



Crossover Distortion

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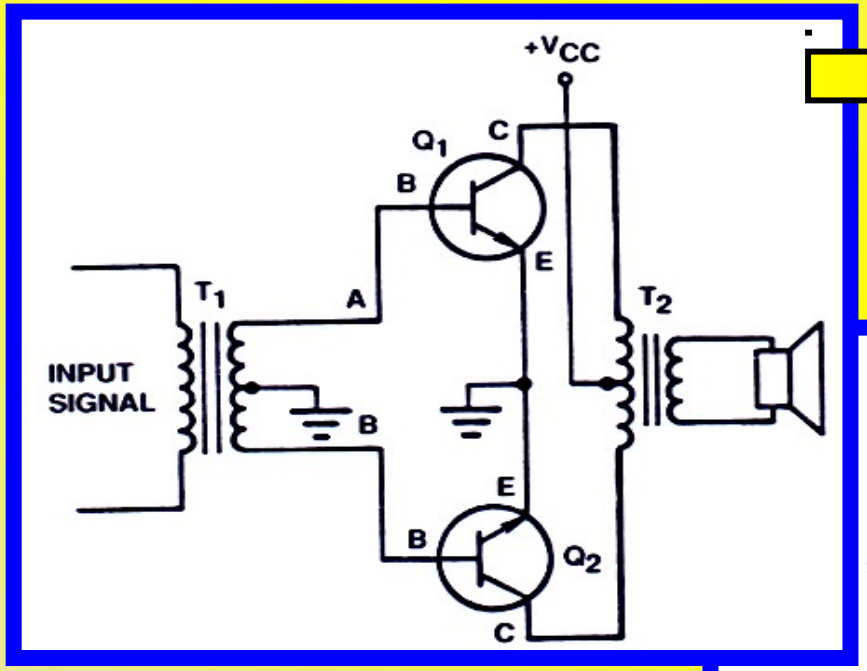
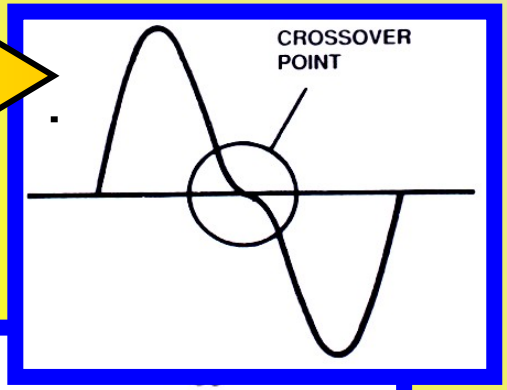
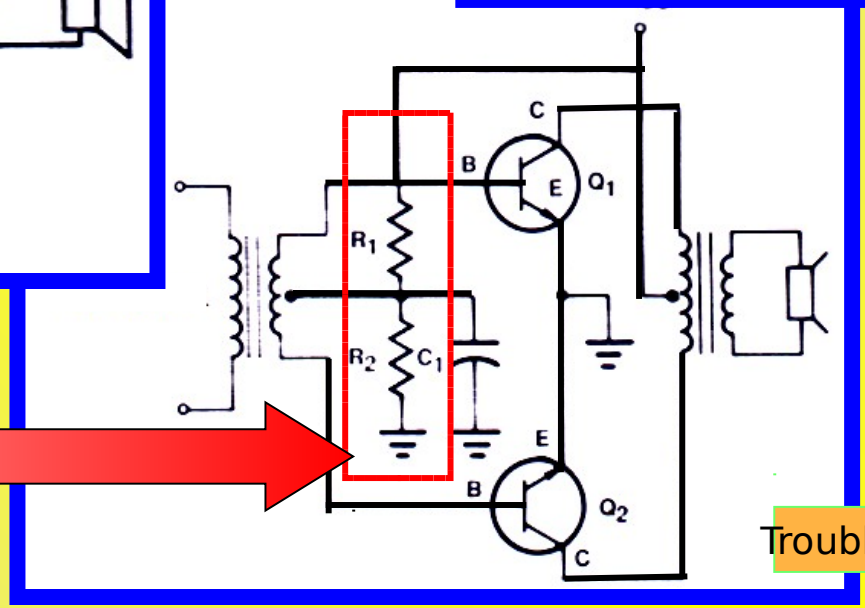
Crossover Distortion;







R1 & 2 Bias Q1 & 2 on.

Troubleshooting

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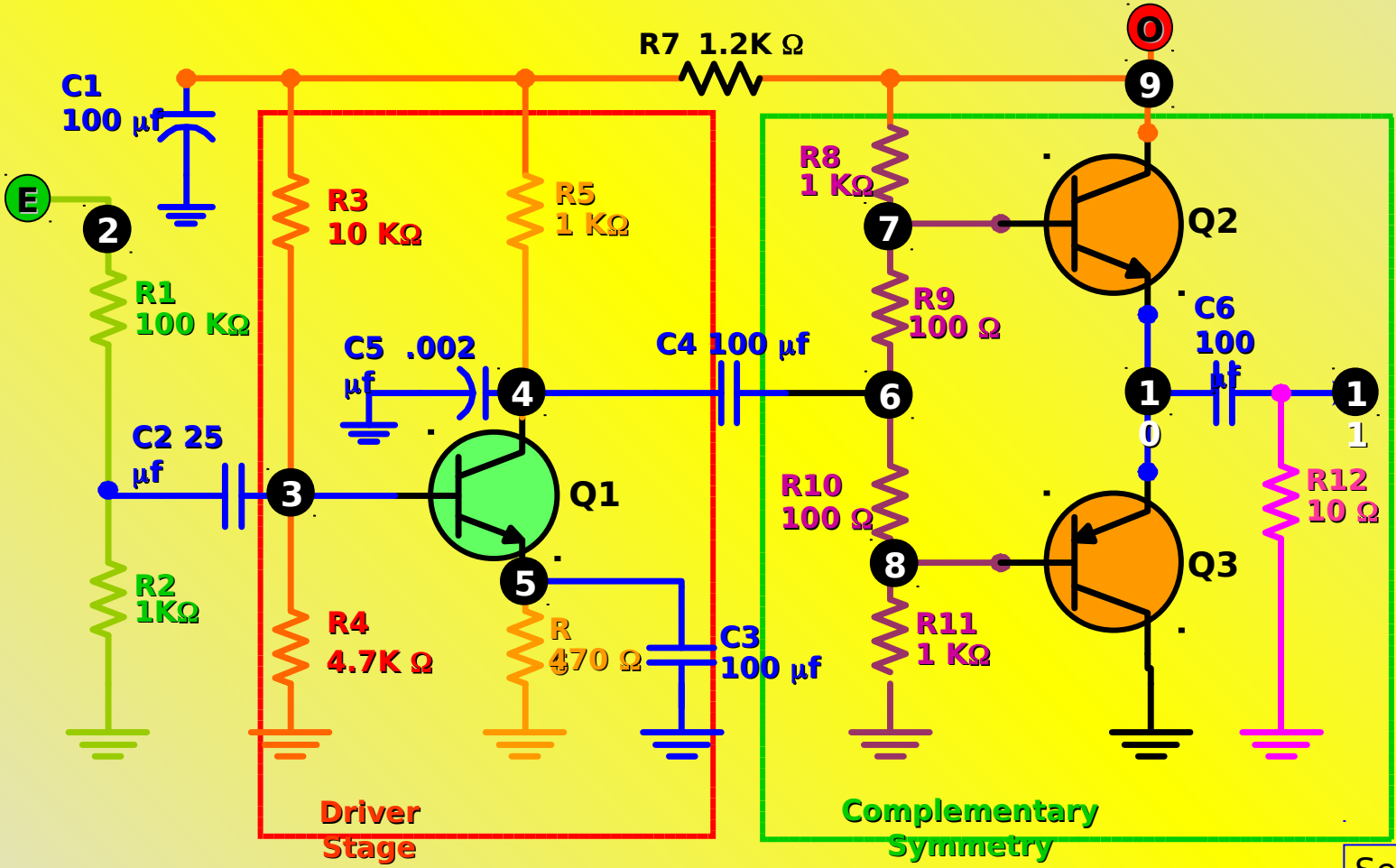
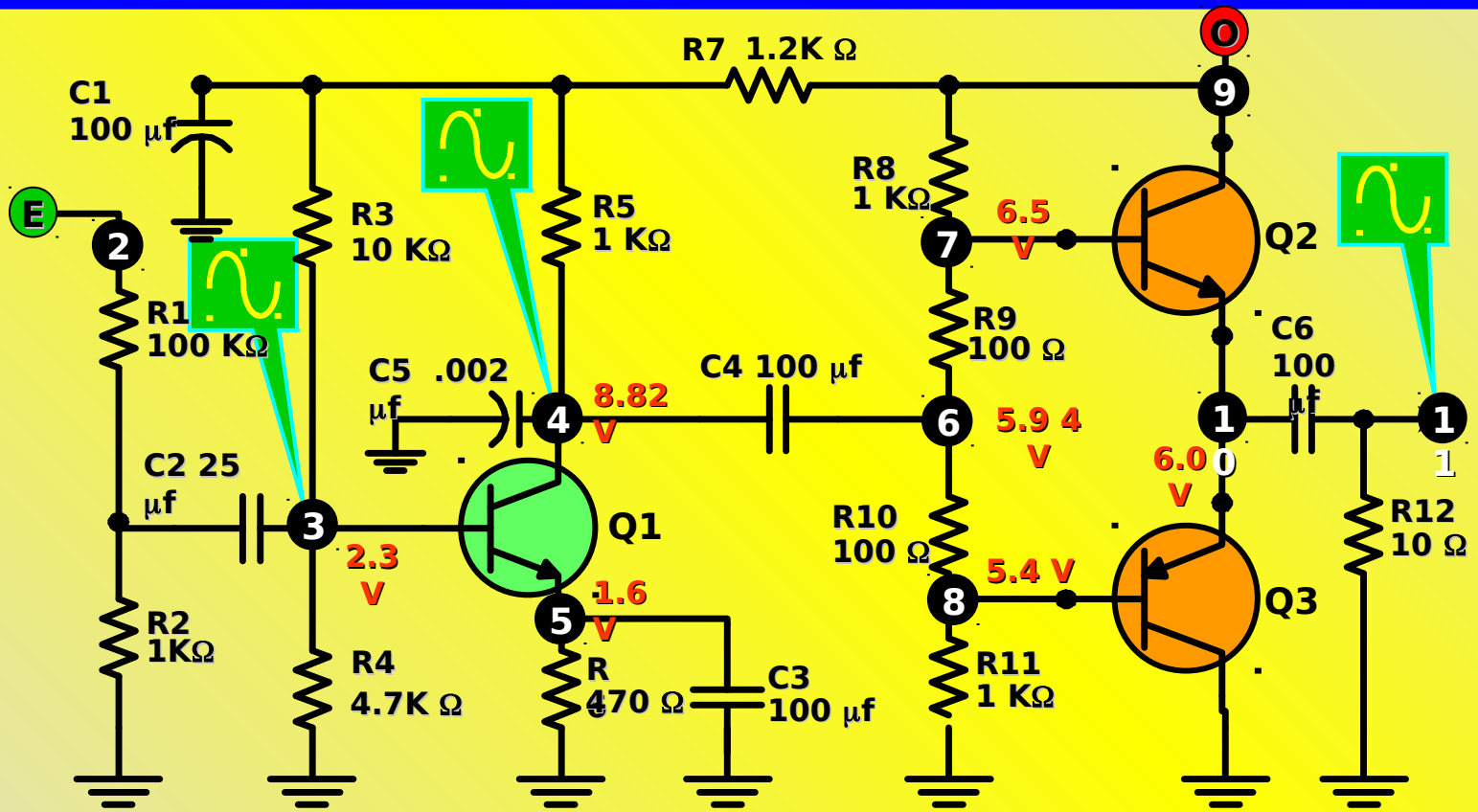
PC-34; Circuits



Sequence

TII: Multistage Amplifiers

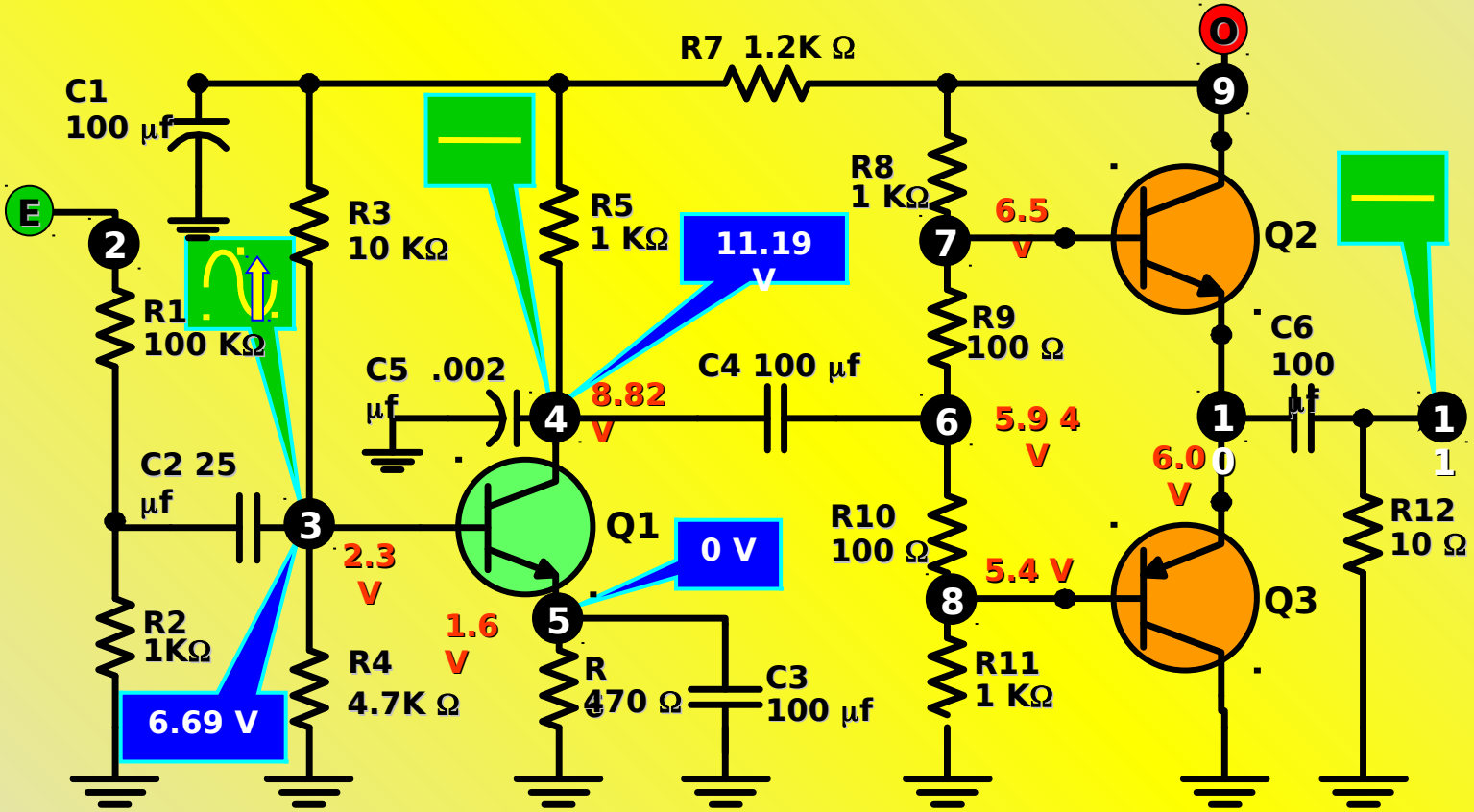
PC-34; Sequence, AC ✓ TP 11, 3, 4, 6. DC ✓, Ω Confirmation.



Challenge 1

TII: Multistage Amplifiers

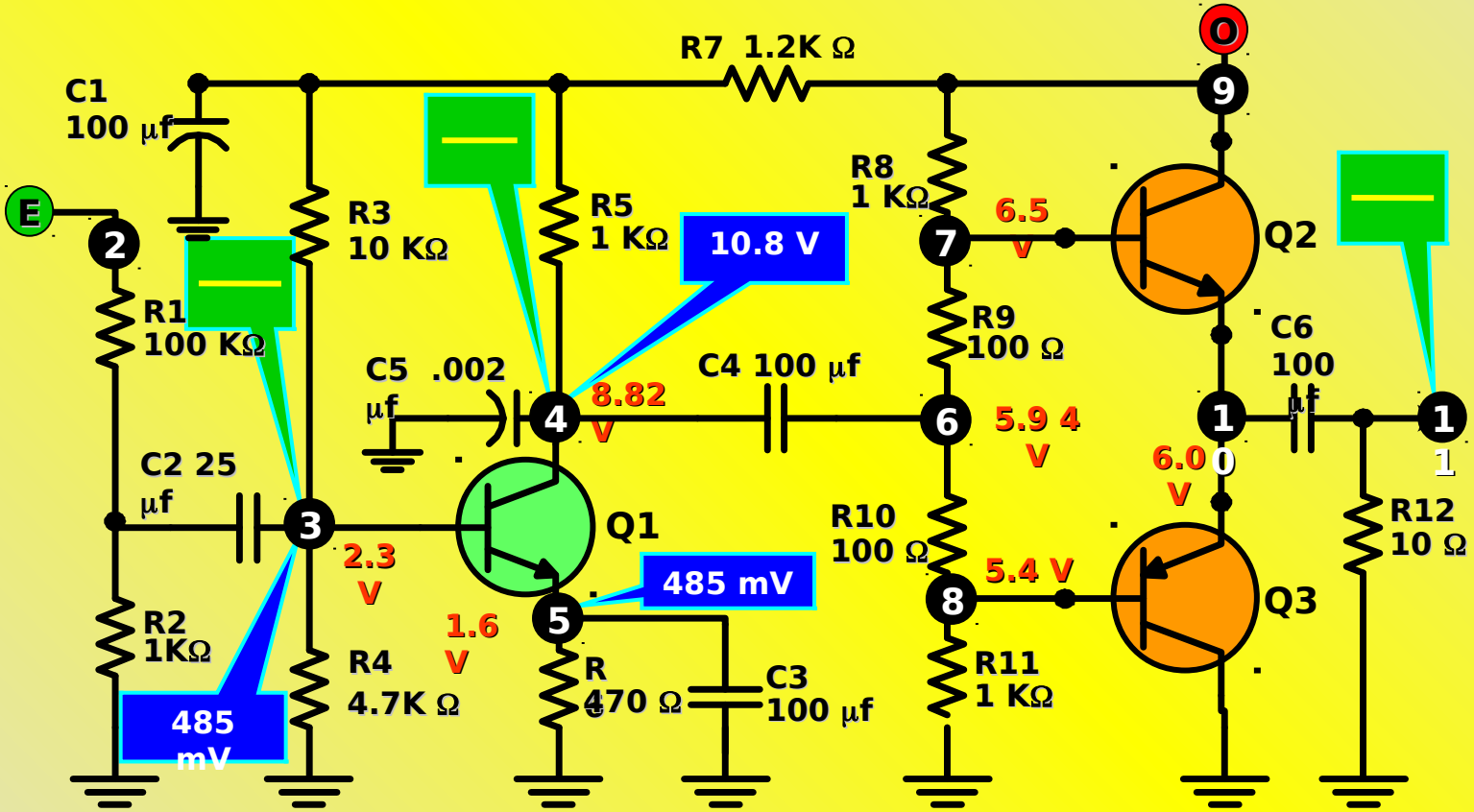
PC-34; Sequence, AC ✓ TP 11, 3, 4.Challenge 1.



Challenge 2

TII: Multistage Amplifiers

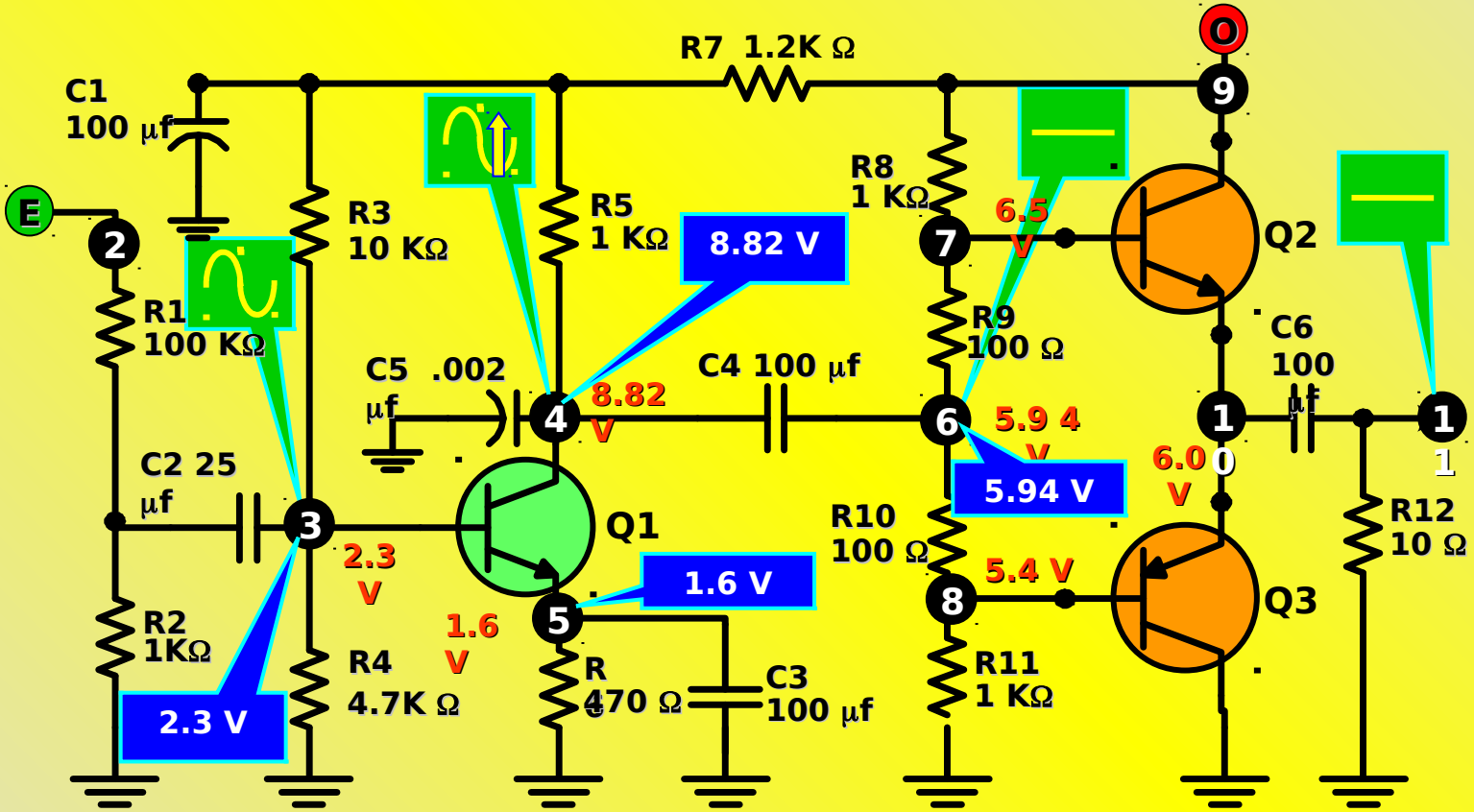
PC-34; Sequence, AC ✓ TP 11, 3, 4.Challenge 2.



Challenge 3

TII: Multistage Amplifiers

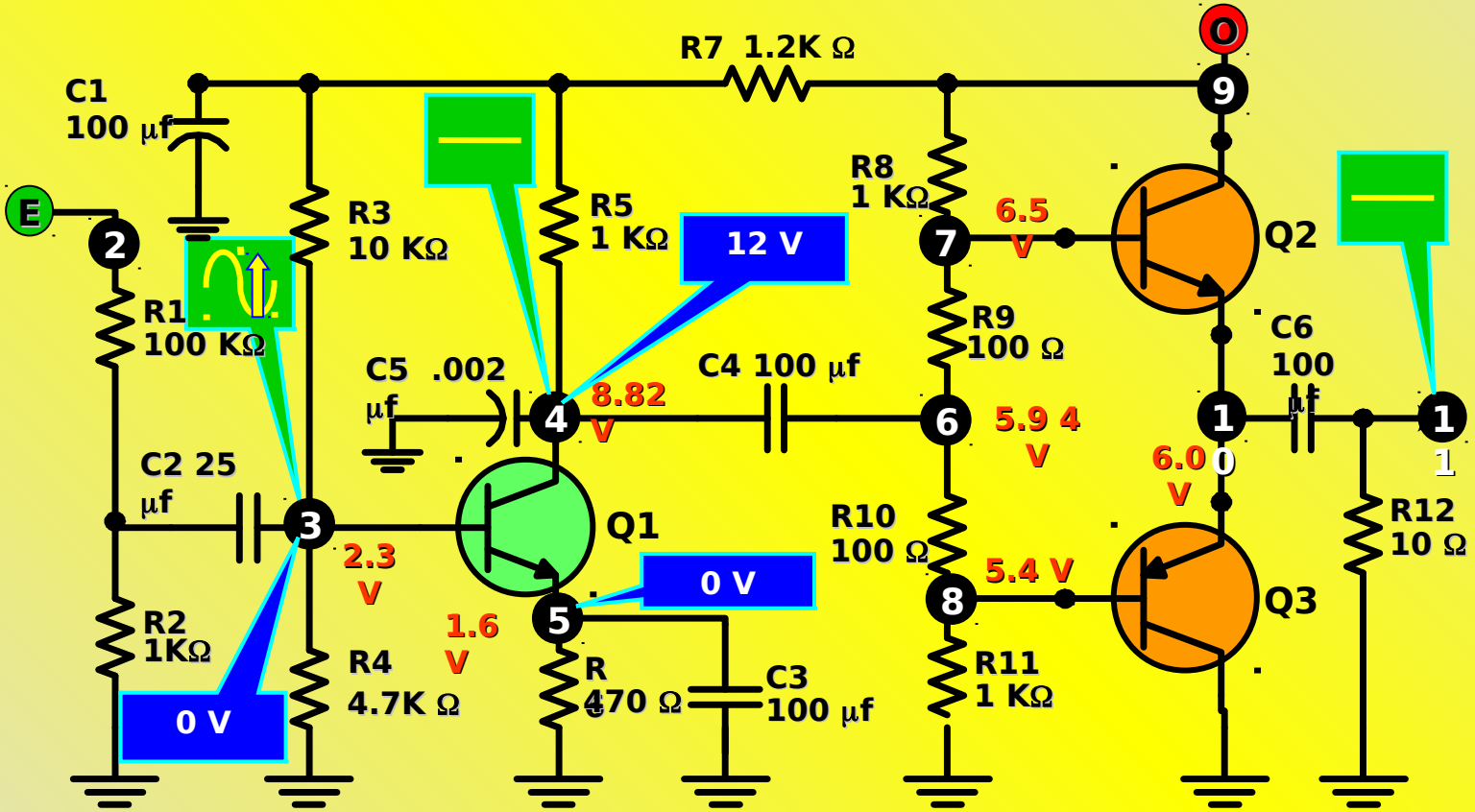
PC-34; Sequence, AC ✓ TP 11, 3, 4, 6. Challenge 3.



Challenge 4

TII: Multistage Amplifiers

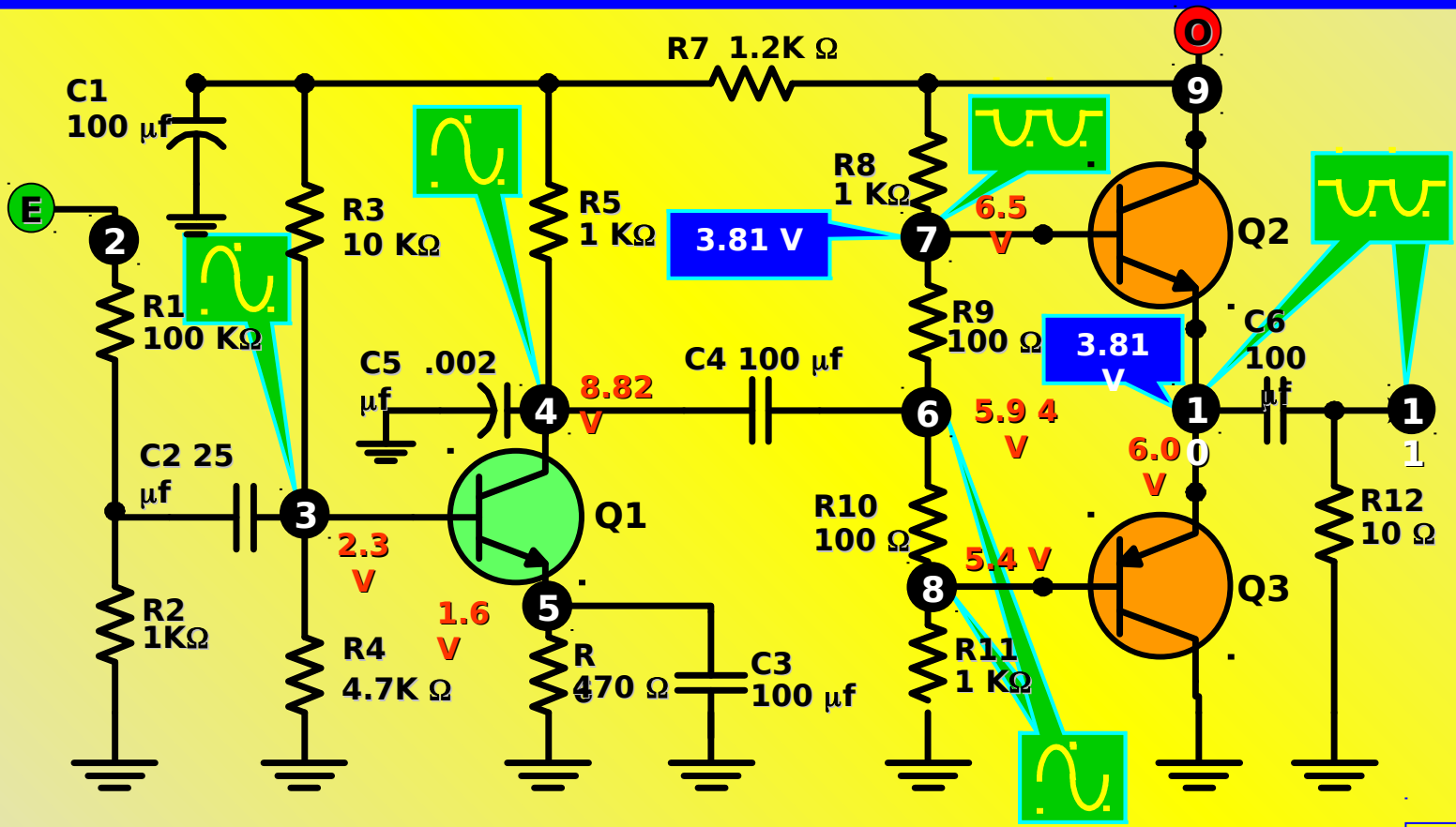
PC-34; Sequence, AC ✓ TP 11, 3, 4.Challenge 4.



Challenge 5

TII: Multistage Amplifiers

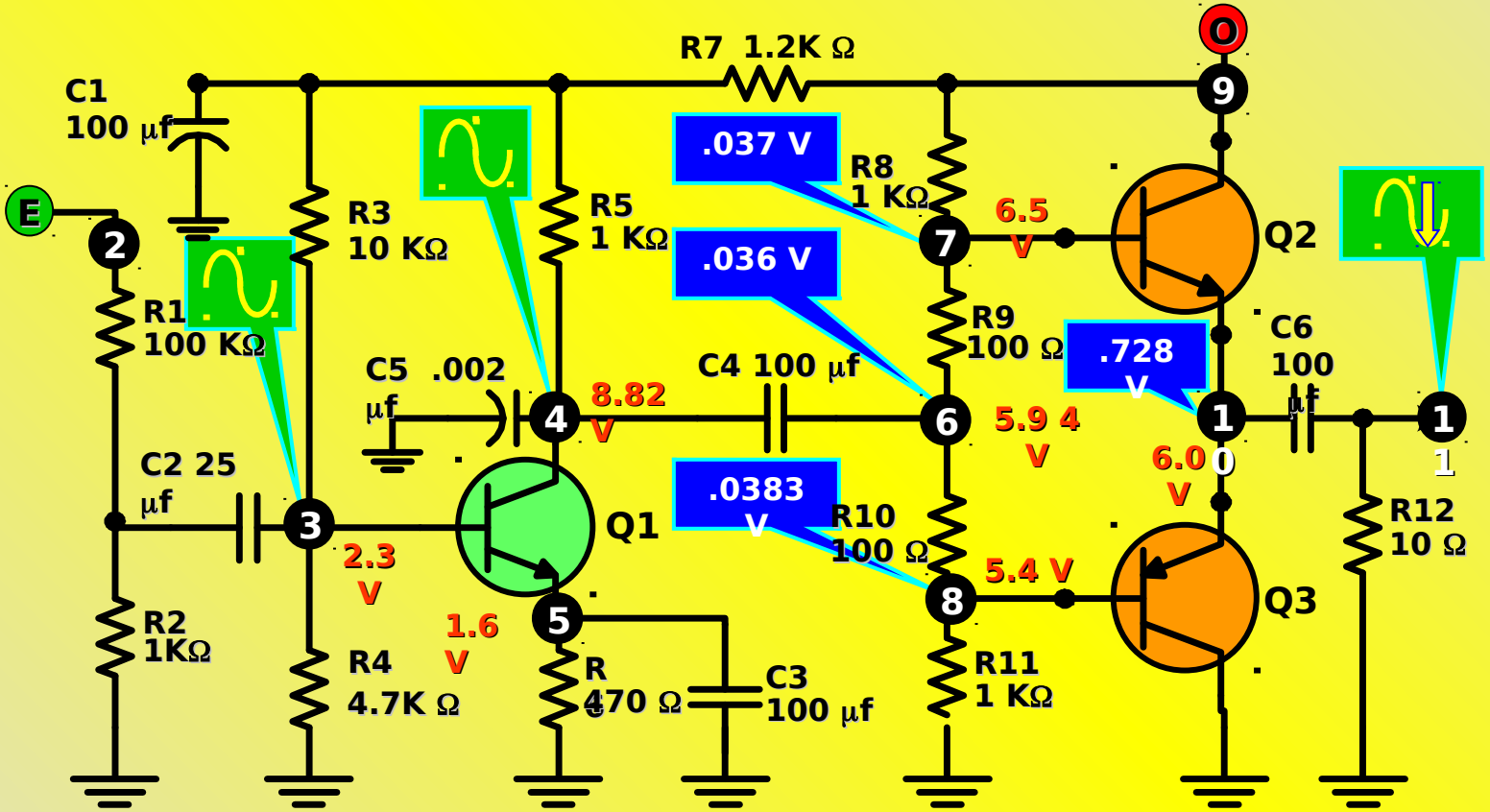
PC-34; Sequence, AC ✓ TP 11, 3, 4, 6 & 8, 7,10.
Challenge 5.



Challenge 6

TII: Multistage Amplifiers

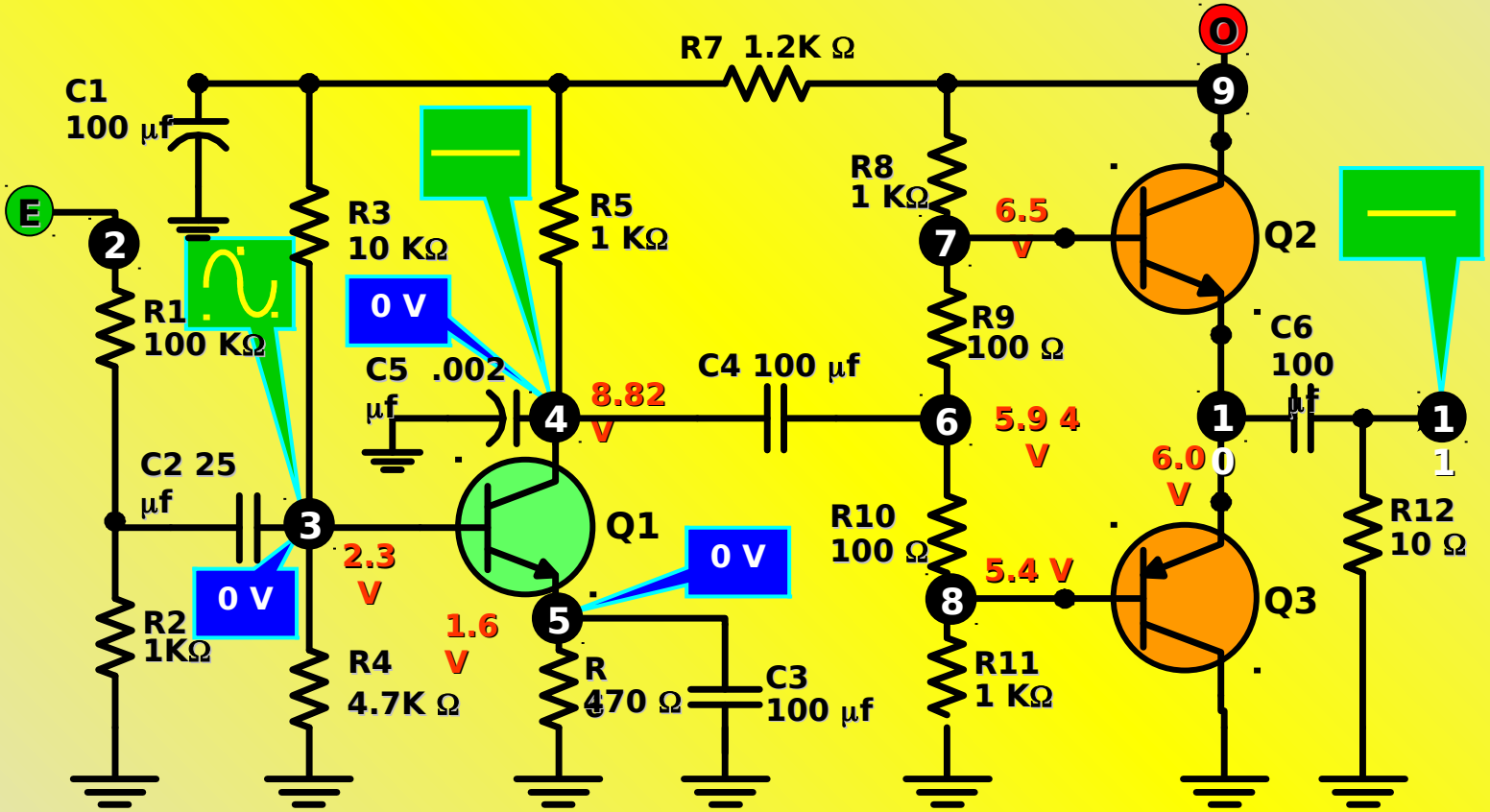
PC-34; Sequence, AC ✓ TP 11, 3, 4, 6. Challenge 6.



Challenge 7

TII: Multistage Amplifiers

PC-34; Sequence, AC ✓ TP 11, 3, 4. Challenge 7.



Review Questions

TII: Multistage Amplifiers

Review Questions;

1. What is the phase relationship of the signals on the bases of Q2 & Q3? _____
2. How are Q2 & Q3 connected in PC 34? _____
3. What Components Develop the bias for Q1? _____
4. What method of troubleshooting is emphasized when troubleshooting PC 34? _____
5. What is the purpose of a driver stage in a complementary symmetry amplifier? _____
6. Q2 & Q3 will conduct _____ when an AC signal is applied to the base of each transistor.
7. The voltage @ TP4 Reads Applied, TP3 lower than normal & TP5 reads 0. What is the malfunction? _____
8. What would be the indication if Q3 B-E junction was shorted? ___

Answers

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Review Questions;

9. Voltage @ TP4 reads applied, TP3 & 5 reads 0. What is the malfunction? _____

10. If C3 in Q1 stage is open, What will happen to the signal voltage @ TP4? _____

11. When will Q1 decrease its conduction?

    a. During the positive alternation

    b. When R3 is open

    c. Will not decrease

    d. When no signal is applied

12. What component develops the output signal for Q1?

    a. R5 c. Input signal

    b. R6 d. R31

Answers

TII: Multistage Amplifiers

Review Questions;

13. There is no output signal, the signal @ TP3 is 0. Tp4 =12.8 VDC, Tp3 = 0 VDC, & TP5 = 0 VDC. What is the possible malfunctioning component?

    a. C2 open

    b. R6 Short

    c. Q2 Open

    d. R4 Short

14. There is no output signal, a good signal @ TP4. Tp9 =12 VDC, Tp7= 800 mVDC, & TP10 = 800 mVDC. What is the possible malfunctioning component?

    a. C4 open

    b. C3 open

    c. Q2 Short B-E

    d. R12 short

Answers

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Lesson Test;

Lesson Test:

Standard: 10 Questions W/in 20 Minutes. 70% Minimum Accuracy. Reference: None.

PC 34

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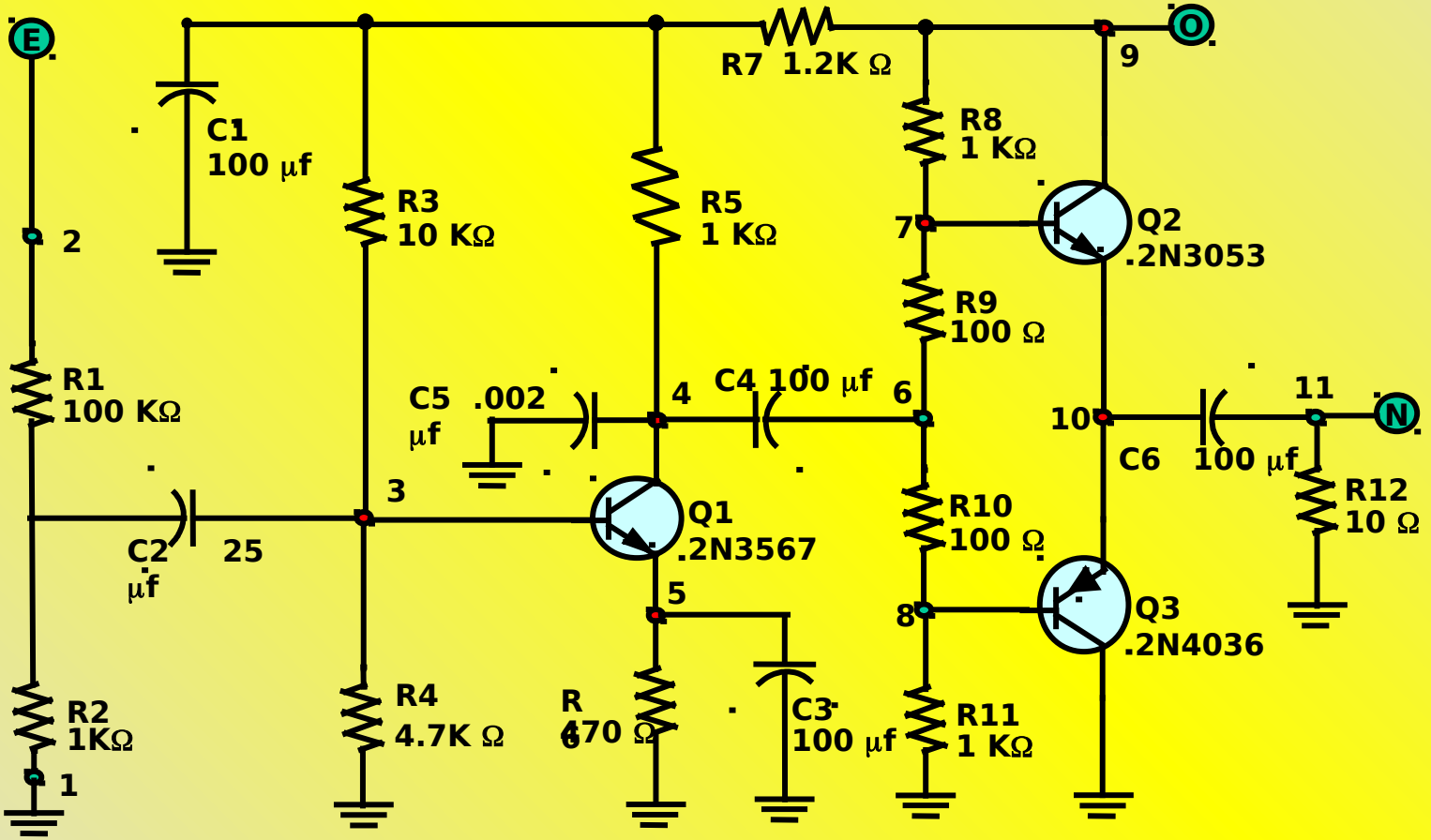
PC 34;



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